

**COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION
DIVISION OF ENERGY REGULATION**

SCC-CLERK'S OFFICE
DOCUMENT CONTROL CENTER

2016 MAY 27 A 9:57

**PREFILED STAFF TESTIMONY OF
DAVID ESSAH
ON THE
APPLICATION OF
VIRGINIA ELECTRIC AND POWER COMPANY
FOR APPROVAL AND CERTIFICATION OF
ELECTRIC TRANSMISSION FACILITIES:
REMINGTON-GORDONSVILLE
230 KV DOUBLE CIRCUIT TRANSMISSION LINE**

CASE NO. PUE-2015-00117

May 27, 2016

SUMMARY

This Staff Report presents Staff's review of Virginia Electric and Power Company's application to the State Corporation Commission for approval and issuance of a certificate of public convenience and necessity to construct and operate electric facilities for a 230 kilovolt transmission line from Remington Substation in Fauquier County to Gordonsville Substation in Culpeper County. The results of Staff's review are summarized below.

- Independent load flow analyses performed during this review confirm that certain violations of transmission facility reliability criteria, projected to occur in the absence of the Project, are valid. The electrical solutions proposed by the Project resolve these violations.
- The route proposed for the transmission line is in existing right-of-way, which minimizes impact on existing residences, scenic assets, historic districts, and the environment.
- The Project could potentially be constructed using shorter structures than currently proposed. Such an option could reduce visual impacts, and is supported by numerous interested parties in the case; however it could also require a wider right-of-way, add more structures than currently proposed in the Application, and increase the cost of the Project.

It is Staff's conclusion that Virginia Electric and Power Company has reasonably demonstrated the need for the proposed Project, and therefore Staff does not oppose the issuance of a certificate for the proposed Project.

PREFILED TESTIMONY

OF

DAVID ESSAH

APPLICATION OF

VIRGINIA ELECTRIC AND POWER COMPANY

CASE NO. PUE-2015-00117

1 **Q1. PLEASE STATE YOUR NAME AND POSITION AT THE**
2 **VIRGINIA STATE CORPORATION COMMISSION.**

3 **A1.** My name is David Essah. I am a Senior Utilities Engineer in the Division
4 of Energy Regulation.

5 **Q2. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

6 **A2.** The purpose of my testimony is to sponsor the Staff Report on the
7 Application of Virginia Electric and Power Company d/b/a Dominion
8 Virginia Power to construct, own, operate and maintain the
9 Remington–Gordonsville 230 kilovolt Transmission Line Project. The
10 Staff Report is attached to this testimony.

11 **Q3. DOES THIS CONCLUDE YOUR TESTIMONY?**

12 **A3.** Yes.

160550134

**COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION
DIVISION OF ENERGY REGULATION**

**STAFF REPORT
ON THE
APPLICATION OF
VIRGINIA ELECTRIC AND POWER COMPANY
FOR APPROVAL AND CERTIFICATION OF
ELECTRIC TRANSMISSION FACILITIES:
REMINGTON-GORDONSVILLE
230 KV DOUBLE CIRCUIT TRANSMISSION LINE**

CASE NO. PUE-2015-00117

May 27, 2016

TABLE OF CONTENTS

INTRODUCTION AND BACKGROUND	1
NEED FOR THE PROPOSED PROJECT	3
PROJECT DETAILS	6
Transmission Line Construction Activities	6
Substation Improvement Activities	8
Right-of-Way and Easements	9
Conductors and Support Structures	10
CONSTRUCTION SCHEDULE	12
PROJECT COST	12
BENEFITS OF THE PROJECT	12
USE OF EXISTING ROW	13
ELECTRICAL ALTERNATIVES	14
VERIFICATION OF LOAD FLOW MODELING	14
PROPOSED ROUTE	16
ECONOMIC DEVELOPMENT	18
DEQ WETLAND IMPACTS CONSULTATION	18
ENVIRONMENTAL, SCENIC, AND HISTORIC IMPACTS	19
Visual Impact of the Project	20
CONCLUSIONS AND RECOMMENDATIONS	23

APPENDICES

- Appendix A: Existing Right-Of-Way Usage Guidance
- Appendix B: Dominion Virginia Power Transmission Planning Standards
- Appendix C: Load Flow Verification Report

ATTACHMENTS

- Attachment 1: Map of Proposed Route
- Attachment 2: Transmission Line Network in the Project Area
- Attachment 3: One-Line Diagram of the Substations
- Attachment 4: ROW Cross-Sectional Views
- Attachment 5: Pictures of Projected Surface Finish for Proposed Structures
- Attachment 6: Company's Responses to Staff's Interrogatory Requests

INTRODUCTION AND BACKGROUND

On November 13, 2015, Virginia Electric and Power Company d/b/a Dominion Virginia Power ("Dominion Virginia Power" or "Company") filed an application ("Application") with the State Corporation Commission ("Commission") for approval and issuance of a certificate of public convenience and necessity ("CPCN") for the proposed Remington–Gordonsville 230 kilovolt ("kV") Double Circuit Transmission Line.

The Company proposes to (a) construct, primarily within existing right-of-way ("ROW"), approximately 38.2 miles of a new 230 kV Line #2153 in Fauquier, Culpeper, Orange, and Albemarle Counties between its existing Remington Substation in Fauquier County and its existing Gordonsville Substation in Albemarle County ("Proposed Route"); and (b) construct and install associated 230 kV facilities at these two substations (collectively, the "Project").¹ In coordination with the Project, the Company also plans to uprate sections of its existing 115 kV Lines #2, #70, and #11, and re-conductor its existing 230 kV Gordonsville–Louisa Line #2088.² A detailed description of the Project is provided later in this Report.

According to the Company, the Project is needed to resolve a number of network reliability violations projected to occur in 2019 by PJM Interconnection

¹ Application at 2.

² *Id.*

1 Environmental Council; William W. Sanford; David W. Taylor;⁵ and Tombstone
2 Limited Partnership, collectively referred to herein as the "Respondents."

3 On April 1, 2016, the Commission Staff filed a Motion for Expedited
4 Summary Ruling that the Proposed Remington–Pratts Alternative Should Not
5 Continue as Part of this Proceeding ("Motion"). All Respondents either supported
6 or did not oppose the Motion. Dominion Virginia Power also filed a response
7 stating that it did not object to the relief sought in the Motion. On April 12, 2016,
8 the Hearing Examiner granted Staff's Motion and directed that the
9 Remington–Pratts Alternatives will not be considered further in this proceeding.

10 The Company's Application provided information responsive to the
11 Commission Staff's "Guidelines of Minimum Requirements for Transmission Line
12 Applications Filed Under Virginia Code Section 56-46.1 and The Utility Facilities
13 Act," dated May 10, 1991. This Staff Report provides a further discussion of the
14 proposed Project, Code of Virginia ("Code") requirements, Virginia Department of
15 Environmental Quality ("DEQ") wetlands consultation and environmental impact
16 review, analyses of need and possible alternatives, economic development, and
17 Staff's conclusions and recommendations.

18 **NEED FOR THE PROPOSED PROJECT**

19 According to the Company, a 2014 PJM network analysis identified several
20 N-1-1 contingencies⁶ for 2019 that produced thermal overloading and low voltage
21 violations on the Company's electrical network.⁷ In particular:

⁵ On May 19, 2016, David W. Taylor filed notice of withdrawal of his Notice of Participation.

- 1 • The N-1-1 loss of 230 kV Gordonsville–Louisa Combustion Turbine ("CT")

2 Line #2088 in conjunction with the loss of Hollymead–Charlottesville Line

3 #2054 produced thermal overload violations in Gordonsville–Oak Green

4 Line #11 and Oak Green–Spotsylvania Line #153. This contingency also

5 produced low voltage violations at the Company's Gordonsville, Somerset,

6 Orange, Oak Green and Hollymead stations; Rappahannock Electric

7 Cooperative's ("REC") Pratts Distribution Point ("DP"); and Central

8 Virginia Electric Cooperative's ("CVEC") Doubleday DP.
- 9 • The N-1-1 loss of Gordonsville–Hollymead Line #2135 coupled with the

10 loss of Gordonsville–Louisa CT Line #2088 produced low voltage

11 violations at the Company's Gordonsville, Somerset, and Orange

12 Substations; REC's Pratts DP; and CVEC's Doubleday DP.
- 13 • The N-1-1 loss of 230 kV Gordonsville–Hollymead Line #2135 coupled

14 with the loss of 230 kV South Anna–North Anna Line #255 produced

15 thermal overload violations on the Company's 115 kV Gordonsville–Oak

16 Green Line #11, 115 kV Oak Green–Spotsylvania Line #153, 115 kV Oak

17 Green–Mountain Run Line #2, and 115 kV Remington–Culpeper Line #70,

18 along with low voltage violations at the Company's Gordonsville,

19 Somerset, Orange, Oak Green, Mitchell, Culpeper, Louisa CT and South

20 Anna stations; REC's Pratts, Mitchell, Mountain Run, Brandy, Unionville,

⁶ An N-1-1 contingency is a sequence of events consisting of the initial loss of a single generator or transmission component (Primary Contingency), followed by system adjustments, and then followed by another loss of a single generator or transmission component (Secondary Contingency).

⁷ Appendix at 15-16.

1 Locust Grove, Paytes, Wilderness, Lake of the Woods, Todds Tavern and
 2 Ni River DPs; the Town of Culpeper's Culpeper DP; and CVEC's
 3 Doubleday DP.

- 4 • The N-1-1 loss of 230-115 kV Transformer #3 at Remington Substation in
 5 conjunction with the loss of either Remington–Remington CT Line #6 or
 6 the 230-115 kV Transformer #9 at Remington CT Station produced a
 7 thermal overload violation in Oak Green–Mountain Run Line #2.
- 8 • The Company states that it also identified a projected stress case violation⁸
 9 of its own Transmission Planning Criteria that needs to be resolved.
 10 Specifically, the removal of the Company's 1,329 megawatt (MW) Warren
 11 County Power Station coupled with the loss of Gordonsville–Hollymead
 12 Line #2135 resulted in projected loading, in 2018, of Gordonsville
 13 Substation's 230-115 kV Transformer #3 to more than 94% of its
 14 emergency thermal limit,⁹ which violates the Company's Transmission
 15 Planning Criteria.¹⁰

16 The 2014 analyses underlying the need case initially called for a 2018 in-
 17 service date for the Project.¹¹ The Company states that in January 2015, PJM
 18 issued its annual Load Forecast,¹² with revised loading for the utility zones within

⁸ *Id.* at 3. North American Electric Reliability Corporation ("NERC") standards permit utilities to add system stressors when evaluating contingencies. *See* Appendix B.

⁹ Company's Response to Staff's Interrogatory No. 1-4. Unless otherwise noted, all interrogatory responses referenced herein are provided in Attachment 6 of this Staff Report.

¹⁰ A summary of the Company's Transmission Planning Standards is provided in Appendix B.

¹¹ Appendix at 4.

¹² PJM's Load Forecast models use trends in equipment and appliance usage, anticipated economic growth and historical weather patterns to estimate growth in peak load and energy use. The models are used to set

its territory. Based on this revised Load Forecast, a new N-1-1 contingency analysis was performed that found the same thermal and voltage violations as before. However, the new analysis showed that the Company-identified stress case violation was now not projected to occur until 2019.¹³ The need date for the Project was subsequently deferred from 2018 to 2019, with PJM's concurrence.¹⁴ Staff's analysis and conclusions regarding the need for the Project is discussed later in this Report.

PROJECT DETAILS

A map of the Project area showing the Proposed Route is shown in Attachment 1. The Company's transmission line system in the Project area, including the proposed Project, is shown in Attachment 2, and the one-line diagrams for substations to be upgraded are shown in Attachment 3.

Transmission Line Construction Activities

The Company proposes to construct a new 230 kV Transmission Line #2153 on double circuit structures between the Company's existing Remington and Gordonsville Substations. Starting from Remington Substation, the new line would initially utilize the vacant lower level of the existing 500/230 kV structures of the Company's 500 kV Meadow Brook–Loudoun Line #535 for 0.6 mile, up to a location referred to in the Application as "Remington Junction."¹⁵ From

the peak loads for capacity obligations, for reliability studies, and to support PJM's Regional Transmission Expansion Plan. The forecast is typically released in January.

¹³ Appendix at 4; Company's Response to Staff's Interrogatory No. 5-55.

¹⁴ Company's Response to Staff's Interrogatory No. 2-15.

¹⁵ Appendix at 2.

1 Remington Junction, the 230 kV line would be constructed on new double circuit
 2 structures along a 37.6 mile stretch of existing ROW leading up to the
 3 Gordonsville Substation. The new 230 kV line would have a summer transfer
 4 capability of 1,047 Mega-volt Amperes ("MVA").¹⁶

5 As part of the construction of this new line, the Company plans to wreck
 6 and rebuild portions of its existing 115 kV Lines #70, #2, and #11 that lie within
 7 the same corridor as the new 230 kV line between Remington Junction and the
 8 Gordonsville Substation.¹⁷ These existing line sections would be rebuilt using up-
 9 rated conductors to increase their transfer capability to 523 MVA.¹⁸ According to
 10 the Company, some of the 115 kV structures within this corridor date back to
 11 1959, are degraded, and require replacement.¹⁹ The rebuilt 115 kV lines would be
 12 mounted on the new double circuit structures to be constructed within this
 13 corridor.

14 Associated with the Project is a 0.8-mile long re-conductoring of the
 15 Company's 230 kV Line #2088 between Gordonsville Substation in Albemarle
 16 County and Louisa Combustion Turbine Switching Station in Louisa County,²⁰
 17 which would increase its load capacity from an existing summer rating of 818
 18 MVA²¹ to 1,140 MVA.²² According to the Company, this transmission

¹⁶ *Id.*

¹⁷ The Company states that some of the 115 kV line sections not proposed for rebuild were recently rebuilt, and hence do not need to be rebuilt at this time. See Company's Response to Staff's Interrogatory No. 2-18.

¹⁸ Appendix at 2, 96.

¹⁹ *Id.* at 4.

²⁰ *Id.* at 1.

²¹ Company's Response to Staff's Interrogatory No. 1-6c.

1 improvement is needed to address N-1-1 contingencies on the 500 kV network in
 2 and around North Anna Power Station.²³ The Company also states that there is no
 3 ground disturbance associated with this work. The Company is not seeking a
 4 CPCN for the 230 kV Line #2088 re-conductoring, or the 115 kV Lines #2, #70,
 5 and #11 wreck-and-rebuilds.

6 The Proposed Route for the Project crosses through a number of counties
 7 for the distances below:

- 8 • Fauquier County for 2.1 miles
- 9 • Culpeper County for 15.7 miles
- 10 • Orange County for 19.2 miles, and
- 11 • Albemarle County for 0.9 mile.

12 Sections of the Project would cross areas covered by the following
 13 certificated service providers: REC for approximately 12.6 miles in Culpeper
 14 County and approximately 4.2 miles in Orange County; and CVEC for 0.1 mile in
 15 Orange County.²⁴ According to the Company, neither service provider objects to
 16 construction of the Project in its coverage area. In response to a Staff
 17 interrogatory, the Company states that it expects no service disruption during
 18 construction of the Project.²⁵

19 Substation Improvement Activities

²² Appendix at 2, 96. The Company states that with the Project in place, this line is not projected to exceed its new ratings within the planning period up to 2023. See Company's Response to Staff's Interrogatory No. 4-41.

²³ Appendix at 2, Fn. 3.

²⁴ *Id.* at 90.

²⁵ Company's Response to Staff's Interrogatory No. 2-21.

Several substation improvements are proposed at Remington and Gordonsville Substations involving upgrades to the ring bus, circuit protection systems, and to the control enclosures.²⁶ In addition, at Gordonsville Substation, the Company proposes to install a third 230-115 kV transformer with associated switchgear. The Company states that without this third transformer, an N-1-1 loss of one of the existing 230-115 kV transformers at that substation together with loss of the Project's 230 kV Remington–Gordonsville Line #2153, would cause the remaining 230-115 kV transformer to become overloaded. The third transformer is therefore proposed to prevent a transformer overload under that N-1-1 contingency.²⁷

Right-of-Way and Easements

The 38.2 mile long Proposed Route, shown in Attachment 1, lies primarily along existing ROW that has been in use since the 1930s.²⁸ However, only 22.2 miles of the existing corridor is 100 feet wide; the remaining 16.0 miles is 70 feet wide. The Company seeks a 100-foot wide ROW for the entire length of the Project wherever practically feasible,²⁹ so an additional 30 feet of permanent ROW (15 feet on both sides of the ROW) is sought in areas having less than 100-foot wide ROW.³⁰ A portion of line proposed to be constructed in the Remington Junction–Remington Substation corridor would use an existing 200-foot wide

²⁶ Direct Testimony of William C. Bland ("Bland Direct") at 3-4; Appendix at 102.

²⁷ Appendix at 2.

²⁸ *Id.* at 137.

²⁹ *Id.* at 83.

³⁰ The Company indicates that a 100-foot ROW width is in accordance with its requirements for 230 kV steel pole construction. See Company's Response to Staff's Interrogatory No. 4-45.

1 ROW that carries the Company's 34.5 kV Line #655, 115 kV Line #70, and 500
2 kV Line #535.

3 Conductors and Support Structures

4 Attachment 4 shows ROW cross-sectional views for the Project. A
5 comparison of the existing and proposed structures along the Proposed Route is
6 also shown in the table below.

EXISTING

Line Section	Line #	Structure Type	Average Height (ft)	Cross-Arm Width (ft)	Base Width (ft)	Line Length (mi)	Average Span (ft)
Gordonsville - Somerset	11	Steel H-Frame	69	42	22	2.11	464
Somerset - Oak Green Junction	11	Wood H-Frame	52	27	15	19.06	622
Oak Green Junction - Mountain Run Junction	2	Wood H-Frame	50	27	15	6.89	569
Mountain Run Junction - Remington Junction	70	Steel H-Frame	55	30	16	9.47	526
Remington Junction - Remington Substation	70 & 655, 535	Weathering Steel, Galvanized Steel	70, 138	10, 84	2, 40	0.62	246, 1014

PROPOSED

Line Section	Line #	Structure Type	Average Height (ft)	Cross-Arm Width (ft)	Base Width (ft)	Line Length (mi)	Average Span (ft)
Gordonsville - Somerset	11 & 2153	Steel Pole	103	34	4	2.13	468
Somerset - Oak Green Junction	11 & 2153	Steel Pole	107	34	4	19.06	625
Oak Green Junction - Mountain Run Junction	2 & 2153	Steel Pole	106	34	4	6.89	569
Mountain Run Junction - Remington Junction	70 & 2153	Steel Pole	104	34	4	9.47	532
Remington Junction - Remington Substation	70 & 655, 535 & 2153	Weathering Steel, Galvanized Steel	70, 138	10, 84	2, 40	0.62	246, 1014

7
8 Within the corridor from Remington Junction to Gordonsville, the
9 approximate average height of the new transmission structures would range from
10 103 to 107 feet. In response to a Staff interrogatory, the Company explains that
11 the basis for the proposed structure heights is to provide the Company-required
12 230 kV ground clearance needed for a structure-for-structure replacement within a
13 100-foot wide ROW.³¹ In comparison, the average height of the existing H-Frame

³¹ Company's Response to Staff's Interrogatory No. 4-48.

structures ranges from 50 to 69 feet.³² Cross-arm widths would also change from 27-42 feet for the existing H-Frame structures, to a proposed width of 34 feet for the new monopoles. The tallest structures along the entire Proposed Route would be existing structures found along the 0.62 mile long Remington Junction – Remington Substation corridor where the new Line #2153 would share the same double circuit structures as 500 kV Line #535.

Despite the taller structures proposed for the Project, the total structure count and average span lengths remain relatively unchanged.³³ In response to a Staff Interrogatory, the Company explains in part that this is because the wreck-and-rebuild effort was planned as a structure-for-structure replacement within a 100-foot wide ROW, while minimizing structure heights.³⁴

All new structures constructed would be weathering steel monopoles. The Company states that this choice was based on (a) projected cost savings when compared to galvanized steel;³⁵ (b) public feedback received by the Company; (c) a closer match with the wooden poles being replaced; and (d) a closer match with newer construction along the corridor that also used weathering steel.³⁶ Three

³² Appendix at 98-100.

³³ There are 346 structures total planned for the Project, compared to 347 existing structures found along the Proposed Route. *See* Company's Response to Staff's Interrogatory No. 1-8a and 1-9a.

³⁴ Company's Response to Staff's Interrogatory No. 4-47.

³⁵ The Company states that galvanized steel poles would cost approximately 5.7% more than weathering steel poles, leading to a \$627,437 increase in estimated cost for the proposed Project. *See* Company's Response to Staff's Interrogatory No. 1-11.

³⁶ *Id.*

1 twin-bundled 636 Aluminum Conductor Steel Reinforced ("ACSR") conductors
 2 would be used throughout the Project.³⁷

3 CONSTRUCTION SCHEDULE

4 The Company states that it needs approximately 11 months for engineering,
 5 material procurement, ROW acquisition, and permitting, and 14-18 months to
 6 construct the Project.³⁸ The requested in-service date for the Project is
 7 June 1, 2019.

8 PROJECT COST

9 The estimated cost of the Project is \$104.6 million (2015 dollars), out of
 10 which \$88.7 million is for transmission line work including the re-conductoring of
 11 Line #2088,³⁹ and \$15.9 million is for substation work (approximately \$5.3
 12 million and \$10.6 million for Remington Substation and Gordonsville Substation,
 13 respectively).⁴⁰ According to the Company, the Company's net share of the
 14 allocated costs of the Project, if approved, would be recovered from Virginia
 15 jurisdictional customers through Rider T1.⁴¹

16 BENEFITS OF THE PROJECT

17 The primary benefit of the Project is increased reliability of the electrical
 18 network in the Project area, since it resolves potential issues that if left

³⁷ Appendix at 97.

³⁸ Application at 3.

³⁹ The re-conductoring of Line #2088 will cost approximately \$580,200. *See* Appendix at 2, Fn. 3.

⁴⁰ Application at 3; Appendix at 61; Bland Direct at 4.

⁴¹ Company's Response to Staff's Interrogatory No. 2-22.

1 unaddressed, could lead to violations of NERC Reliability Standards⁴² or the
 2 Company's Transmission Planning Criteria. According to the Company, the
 3 Project would prevent potential service interruptions or damage to facilities owned
 4 by the Company and its service providers, and would also provide increased
 5 capacity to support future load growth in the region.⁴³

6 The Company indicates that rebuilding the aging 115 kV lines onto the new
 7 structures proposed for the Project also provides an ancillary benefit. It explains
 8 that several wooden H-frame structures making up those aging 115 kV lines have
 9 degraded and need to be replaced, and others will also need replacement over
 10 time.⁴⁴ Construction of the Project would therefore eliminate that future need and
 11 the cost to replace at least 12.2 miles of 115 kV line; that future cost is estimated
 12 at \$18.3 million in 2015 dollars.⁴⁵ The Staff concurs with these estimated
 13 benefits.

14 **USE OF EXISTING ROW**

15 As previously stated, the entire 38.2 mile length of the Proposed Route
 16 would be constructed within existing ROW. The only exceptions are in areas
 17 where the ROW width is desired to be expanded from 70 feet to 100 feet. The
 18 statutory requirement to consider the use of existing ROW in locating electric
 19 utility facilities is addressed in Appendix A.

⁴² Appendix at 4.

⁴³ *Id.*

⁴⁴ *Id.*

⁴⁵ *Id.*

ELECTRICAL ALTERNATIVES

The Remington-Pratts Alternatives presented in the Application and included in the public notice were removed from further consideration by the Hearing Examiner's April 12, 2016 ruling, and are therefore not discussed in this Report. However, the Application also describes a different electrical alternative that the Company proposed to PJM to address the identified network violations. That alternative involved construction of a new 230 kV line along existing ROW between Gordonsville Substation and North Anna.⁴⁶ It was eliminated from further consideration because it failed to resolve the identified thermal overload violations.

VERIFICATION OF LOAD FLOW MODELING

The Application notes that the proposed Project initially failed to resolve the violations identified in PJM's load flow modeling until "appropriate adjustments" had been made by PJM to the modeling, after which the Project was found to resolve all identified violations.⁴⁷ In response to a Staff interrogatory,⁴⁸ the Company explained that PJM initially failed to include the planned uprate of a section of the Company's Line #2 between Mitchell and Mountain Run, mistakenly leading to a thermal overload of that line during an N-1-1 contingency event. According to the Company, once this line uprate was included in the load

⁴⁶ *Id.* at 33.

⁴⁷ *Id.* at 33, Fn. 12.

⁴⁸ Company's Response to Staff's Interrogatory No. 2-16.

1 flow model, the proposed Project resolved the violation. The Staff's investigation
2 supports this assertion.

3 The Staff retained the services of GDS Associates, Inc. ("GDS") to provide
4 an independent analysis of the Company's load flow modeling and contingency
5 analyses for the Project. GDS analyzed the power flow models provided by the
6 Company in order to verify and confirm the results provided by the Company, and
7 then provided a report of its findings ("GDS Report") to the Staff. The GDS
8 Report notes that the Application referenced four separate power flow analyses in
9 its Application based upon the following:

- 10 • PJM's 2014 Open Window #2,⁴⁹
- 11 • A 2014 Stress Case Analysis,
- 12 • A 2019 Power Flow Analysis using PJM's 2015 Load Forecast, and
- 13 • A 2023 Power Flow Analysis using PJM's 2015 Load Forecast.

14 In its Report, GDS agrees with the results of the power flow analysis
15 performed by the Company in support of its Application, and states that it has
16 successfully reviewed and verified the Company's analysis for the Project. A
17 summary of GDS' results is provided below:

⁴⁹ PJM's Federal Energy Regulatory Commission ("FERC") Order 1000 compliance filing expands PJM's regional planning process to provide greater opportunity for non-incumbent transmission developers to submit solution proposals. PJM's filing establishes proposal windows ("Open Windows") allowing for competitive solicitation, while balancing the need for projects to be selected, sited and constructed in time to solve identified reliability violations.

1 second crossing of Tinpot Road, and then crosses the Rappahannock River. It
2 continues southwards into Culpeper County for 7.5 miles, crossing Newbys Shop
3 Road, Kellys Ford Road, Berry Hill Road, Flat Run, Carrico Mills Road,
4 Mountain Run, and then continuing southwards to cross Fairfield Lane and York
5 Road in Stevensburg. From there it continues southwest, crossing Batna Road,
6 Kibler Road, Potato Run, and Mount Pony Road, running 3.8 miles before
7 crossing Raccoon Ford Road, Cedar Run, and Zachary Taylor Highway. It
8 continues southwest, crossing Somerville Road, and then enters Orange County at
9 the Rapidan River.

10 Continuing southwards, the route crosses Clarks Mountain Road, Mount
11 Sharon Road, and then parallels the east side of Rapidan Road for 4.1 miles until it
12 reaches the Town of Orange. The route then shifts west, crossing Constitution
13 Highway and Monrovia Road before turning southwards to parallel the
14 southeastern side of James Madison Highway for 2.8 miles. It crosses this
15 highway and then parallels it on the west side before reaching the Somerset
16 Substation where it crosses the Blue Ridge Turnpike and Spotswood Trail in
17 Gordonsville. The route then parallels the northwest side of Gordon Avenue. It
18 crosses the South Anna River and enters Albemarle County, continuing southwest
19 until it reaches Gordonsville Substation.

20 The Proposed Route lies primarily along existing ROW, the only
21 exceptions being those areas where the ROW width needs to be expanded from 70

feet to 100 feet. For this reason the Company proposes no alternative routes between the end-points of the Project, and the Staff agrees with this decision.

ECONOMIC DEVELOPMENT

According to the Application, the Project would allow the Company to continue to provide reliable electric service, and enable it to maintain the overall long term reliability of the transmission system. The Project would therefore support continued economic development in Virginia by reinforcing the transmission system in order to maintain and improve reliability in the Company's territory.⁵⁰ The Staff agrees with this assessment.

DEQ WETLAND IMPACTS CONSULTATION

In response to a Staff request, the DEQ Office of Wetlands and Stream Protection ("OWSP") conducted a wetland impact consultation ("WIC") of the proposal, as required by the Code⁵¹ and Sections 2 and 3 of the DEQ-Commission Memorandum of Agreement Regarding Consultation on Wetland Impacts.⁵² The OWSP WIC was included in the DEQ's report to the Commission on the environmental impacts of the Project ("DEQ Report"), which is discussed further below. The WIC offered a number of general recommendations, and listed potential permits that might be required.

⁵⁰ Direct Testimony of David C. Witt at 8-9.

⁵¹ Va. Code §62.1-44.15:21.

⁵² See *In the Matter of Receiving comments on a draft memorandum of agreement between the State Water Control Board and the State Corporation Commission*, Case No. PUE-2003-00114, 2003 S.C.C. Ann. Rept. 474, Order Distributing Memorandum of Agreement (July 30, 2003).

ENVIRONMENTAL, SCENIC, AND HISTORIC IMPACTS

The Company obtained the services of Natural Resources Group to conduct an environmental, scenic, and historical impact assessment of the Project Area. The results, including the impacts on land use, are presented in the Environmental Routing Study ("ERS") found in Volumes 2 and 3 of the Company's Application. There are 191 dwellings located within 500 feet of the centerline of the Proposed Route, and 30 homes within 100 feet of the centerline.⁵³ The Company states that it does not expect any dwellings or businesses to be demolished or relocated for the Project, since the rebuild can occur within a 70-foot ROW in those situations identified where it is not practically feasible to expand the ROW to 100 feet.⁵⁴ However, the ROW width expansion from 70 feet to 100 feet in certain areas, if implemented, affects seven new private parcel landowners and adds 59.8 acres of new, permanent ROW.⁵⁵ The Company states that the current Comprehensive Plans of all counties crossed by the Proposed Route indicate that construction of the Project should have no significant impacts on future land use.⁵⁶

The Staff also requested the DEQ to coordinate a review of the Application by the appropriate agencies and provide a report on the review.⁵⁷ DEQ filed its Report, which included findings and recommendations for consideration by the

⁵³ Appendix at 108; Direct Testimony of Company Witness Greg Baka ("Baka Direct") at 10-11. ERS Volume 2 at 62.

⁵⁴ Baka Direct at 4.

⁵⁵ ERS Volume 2 at 58.

⁵⁶ Appendix at 139.

⁵⁷ Letter from Alisson Klaiber, State Corporation Commission, dated November 16, 2015, to Bettina Sullivan, Program Manager, Environmental Impact Review, DEQ, filed in Case No. PUE-2015-00117.

1 Commission, on February 1, 2016.⁵⁸ The DEQ Report also included copies of
2 comments provided to DEQ by the reviewing agencies.

3 Visual Impact of the Project

4 During the course of this proceeding, a significant number of public
5 comments were received pertaining to the view-shed impact of the Project on the
6 conservation easements and historic and scenic resources found along the
7 Proposed Route. At a local public hearing held on April 28, 2016 in Orange, VA,
8 numerous public witnesses requested that the structure heights be limited to a
9 maximum of 80 feet in order to minimize visibility over tree lines, and that the
10 Company be required to use dulled steel towers with a rust-colored appearance to
11 blend better with the landscape.

12 In response to a Staff interrogatory, the Company stated that the structures
13 proposed for the Project are non-reflective, rust-colored or brown structures that
14 are consistent with the dulled-steel structures proposed by the Virginia Outdoors
15 Foundation ("VOF") in the DEQ Report.⁵⁹ The Company provided Staff with
16 pictures showing the expected initial surface finish of a typical structure, and the
17 projected surface finish after approximately eight years of weather exposure
18 (Attachment 5). Based on its investigation, the Staff concurs that this proposed
19 choice of surface finish is a prudent choice that reduces visual impacts of the
20 Project.

⁵⁸ Letter from Bettina Sullivan, DEQ Program Manager, dated February 1, 2016, to Joel H. Peck, Clerk, filed in Case No. PUE-2015-00117.

⁵⁹ Company's Response to Staff's Interrogatory No. 4-43.

1 In response to a Staff interrogatory, the Company stated that it plans to use
 2 its standard conductors for the Project, consisting of aluminum stranded wires that
 3 are silver in color until the wire begins to fade and dull to a muted gray.⁶⁰ It
 4 estimates that the incremental cost of using non-reflecting or de-glared conductors
 5 to reduce visual impact, as proposed by the VOF in the DEQ Report, would be
 6 approximately \$60,000.⁶¹ The Staff considers this incremental cost to be minimal
 7 (less than 0.06% of the total Project cost⁶²) and therefore recommends the use of
 8 these conductors as an additional visual impact reduction strategy.

9 With respect to reducing structure heights, the Company states that among
 10 other impacts, the cost of the Project would increase if shorter structures were used
 11 in a structure-for-structure replacement in a 100-foot ROW along the wreck and
 12 rebuild corridor.⁶³ In response to a Staff interrogatory, the Company stated that:

- 13 • A hypothetical single circuit 230 kV H-frame structure, constructed
 14 alongside the existing 115 kV structures using the Company's standard
 15 design, would be on average approximately 41 feet shorter than the
 16 proposed double circuit structures; however, this arrangement would
 17 require a 180-foot wide ROW to accommodate both structures.⁶⁴
- 18 • A hypothetical double circuit H-frame structure, constructed to support
 19 both the existing 115 kV line and the new 230 kV line, using the

⁶⁰ Company's Response to Staff's Interrogatory No. 4-44.

⁶¹ *Id.*

⁶² $(\$60K/\$104.6M \times 100\%) = 0.057\%$

⁶³ Company's Response to Staff's Interrogatory No. 4-50.

⁶⁴ *Id.*

Company's standard design, would be on average approximately 22 feet shorter than the proposed double circuit structures, but would require a 140-foot wide ROW.⁶⁵

The table below summarizes Staff's assessment of the impact of these two hypothetical scenarios on the Project.⁶⁶

Impact	Proposed Project	Shorter structures using H-Frames	
		2-single-circuit	1-double-circuit
ROW width in rebuild corridor (feet)	100	180	140
Average structure height in rebuild corridor (feet)	103 - 107	63 - 67	81 - 85
Total No. of structures required for the Project	346	688	346

The Staff recognizes and understands the concerns expressed at the local public hearing on April 28, 2016, regarding the impacts of taller structures on the existing view-shed. Ultimately, a decision on whether to use the shorter structures is a judgment call that must balance competing interests. The Staff does not take a position with respect to structure height, but notes the following: a) constructing the Project at the lower structure height is, or appears to Staff to be technically feasible; b) using the lower structure heights is supported by citizens that provided

⁶⁵ *Id.*

⁶⁶ The average heights of the hypothetical shorter structures found in the table are calculated by Staff, based on an estimated structure height reduction of 40.53 feet and 22.23 feet respectively for the 2-single-circuit and 1-double-circuit arrangement. See Company's Response to Staff's Interrogatory No. 4-50. The total number of structures required for the 1-double-circuit structure configuration is estimated by Staff to equal that of the proposed Project (i.e. 346 structures), for a structure-for-structure replacement. For a 2-single-circuit structure configuration, the total structure count is calculated as twice the number of existing structures found in the Remington Junction – Gordonsville (wreck-and-rebuild) corridor, plus the number of existing structures (i.e. 4 structures) being used in the Remington Junction – Remington Substation corridor, i.e. in total, $2 \times (346 - 4) + 4$ structures = 688 structures. No Project cost estimates for these hypothetical shorter structure configurations were available from the Company at the time of this Report.

1 public comments in this case; but c) if the shorter structures are used, a wider
2 ROW will likely be required, or the number of structures could potentially
3 increase⁶⁷ (increasing visual impact of the Project), and the cost of the Project
4 would increase as well. Given the great public interest expressed for the use of
5 shorter support structures, Staff hopes to be able to supply further information on
6 the issue of additional costs in either supplemental testimony or during the
7 proceeding.

8 CONCLUSIONS AND RECOMMENDATIONS

9 After investigating the Company's Application, the Staff concludes that the
10 Company has reasonably demonstrated the need to construct, own, operate and
11 maintain the Remington–Gordonsville 230 kV Transmission Line Project. Based
12 on an independent review of the Company's load flow studies, the Staff concludes
13 that the proposed Project addresses the electrical violations identified by PJM and
14 the Company. The Project primarily utilizes existing ROW, and therefore
15 minimizes cost, new ROW requirements, and the impact on existing residences,
16 scenic assets, historic districts, and the environment.

17 Based on Staff's investigation, the Project as currently proposed in the
18 Application, or a rebuild that instead uses shorter structures than the average
19 heights currently proposed, are both technically viable options to address the
20 Project need, although the latter option would involve trade-offs in cost, ROW
21 requirements, and total structure count. The Staff also recommends the use of

⁶⁷ *Id.*

1 non-reflecting or de-glared conductors for the Project, to further reduce visual
2 impacts. In summary, the Staff does not oppose the Company's request that the
3 Commission issue the necessary CPCN for the proposed Project.

4

Appendix A
Existing Right-Of-Way Usage Guidance

1 The statutory requirement to consider the use of existing ROW in locating
 2 electric utility facilities, as directed by §§56-46.1 C and 56-259 C of the Code,
 3 minimizes the incremental environmental impact and cost associated with building
 4 new electric transmission facilities. In addition, in Staff's view, the joint use of
 5 ROW by public service corporations is contemplated by the Code. These sections
 6 of the Code align with §380.15 of the Code of Federal Regulations – *Siting and*
 7 *maintenance requirements*,⁶⁸ in which Guideline (a) states "[t]he siting,
 8 construction, and maintenance of facilities shall be undertaken in a way that
 9 avoids or minimizes effects on scenic, historic, wildlife, and recreational values";
 10 and Guideline (d) (1) states, "[t]he use, widening, or extension of existing rights-
 11 of-way must be considered in locating proposed facilities." It is common practice
 12 also to consider routes on new easements that parallel existing linear utility and
 13 transportation facilities such as electric transmission lines and railroads.

⁶⁸ 18 CFR 380.15.

Appendix B

Dominion Virginia Power Transmission Planning Standards

DOMINION VIRGINIA POWER
TRANSMISSION PLANNING STANDARDS

Dominion Virginia Power plans the expansion of its transmission system in response to forecasted load growth in a manner that assures compliance with the NERC transmission planning standards, as mandated by the FERC in accordance with the Energy Policy Act of 2005. As a member of PJM, Dominion Virginia Power transmission planning is conducted in concert with PJM's planning. The PJM Regional Transmission Expansion Plan combines the PJM planning criteria with the planning criteria of each Transmission Owner and conducts one assessment that is measured against the NERC transmission planning reliability standards.

Mandatory NERC Reliability Standards require that the interconnected transmission system be studied for reliability compliance from the perspective of two time horizons: near term (years 1-5), and long term (years 6-10). When planning studies reveal a NERC planning standard violation for a future year within the Company's planning horizon, Dominion Virginia Power initiates the process to build and operate a suitable bulk power reinforcement that may take the form of a new transmission circuit, an upgraded transmission circuit, a new large power transformer at a station, a new station, or a combination of these.

Key to NERC's standards is that a transmission system be planned to operate within an acceptable voltage range, without damage to equipment from overloading, and with specified limited dropping of load, following system

1 contingencies. A contingency is the unexpected failure of a critical component of
2 the bulk power system, such as a transmission circuit, a double circuit
3 transmission line, a large power transformer, or a generating unit. NERC
4 standards also permit a utility to add system stressors to the contingency. In the
5 case of Virginia Power, a typical system stressor is the unavailability of the largest
6 generating unit located electrically near the contingency.

7 Contingencies fall into eight categories, Categories P0 to P7. NERC
8 Reliability Standards provide for different system responses based on the severity
9 of the system test (Category P0 is the least severe test and Categories P6 and P7
10 are the most severe). These eight contingency categories are described as follows:

- 11 • Category P0: No Contingencies.
- 12 • Category P1 and P2: Event resulting in the loss of a single element.
- 13 • Category P3 through P7: Event(s) resulting in the loss of two or more
14 (multiple) elements.

15 For Category P0 through P7 events, it is expected that the system will remain
16 stable, and that both thermal and voltage limits will remain within applicable
17 ratings.

Appendix C

Load Flow Verification Report

1 VIRGINIA STATE CORPORATION COMMISSION

2 CASE NO. PUE-2015-00117

3 ASSESSMENT OF REMINGTON-GORDONSVILLE 230 KV
4 TRANSMISSION LINE PROJECT5 BACKGROUND

6 GDS Associates, Inc. ("GDS") has been retained by Commission Staff to
7 provide an independent assessment of the proposed Remington–Gordonsville 230
8 kV Transmission Line Project ("Project") with respect to the review and
9 verification of the power flow modeling and contingency analysis results provided
10 by the Company in support of the Application to justify the need for the Project.
11 This letter discusses the results of the GDS assessment which includes the
12 following: (i) review of the power flow modeling of the local system, including
13 load, generation, and transmission system topology; (ii) review of the power flow
14 input files such as the monitored element definition (.MON) files, contingency
15 definition (.CON) files, and subsystem definition (.SUB) files; and (iii)
16 verification of the results of the multiple contingency (N-1-1) analysis. The
17 purpose of the review and verification is not to make a determination regarding
18 any routing or environmental issues, but is only intended to ensure that the
19 modeling assumptions used by the Company are accurate and consistent with
20 acceptable utility practices and that power flow results used in the Application can
21 be independently verified.

22 DESCRIPTION OF THE PROJECT

Virginia Electric and Power Company (“Dominion Virginia Power” or “Company”) has proposed to construct, own, operate and maintain the Project, which includes the following components:⁶⁹

a. Installation of approximately 38.2 miles of the 230 kV Remington–Gordonsville Line #2153 in Fauquier, Culpeper, Orange, and Albemarle Counties, project between the existing Remington Substation in Fauquier County and existing Gordonsville Substation in Albemarle County,

b. Construct and install associated 230 kV facilities at the Project, and

c. Uprate sections of existing 115 kV Lines #2, #70 and #11 located on structures proposed for the Project and re-conductor 230 kV Gordonsville–Louisa Line #2088.

NEED DETERMINATION PROVIDED BY COMPANY

The Company has identified the Project to be in service by June 1, 2019, to:⁷⁰

1. Assure continuation of reliable electric service to customers served from the existing Gordonsville Substation, and

2. Address projected violations of NERC Reliability Standards that could lead to service interruptions or potentially damage electrical facilities in the area.

It should be noted that the GDS role in this proceeding is related to the need determination for the Project based on the identified thermal and voltage

⁶⁹ Application at 2-3.

⁷⁰ *Id.*

violations and the subsequent effectiveness of the Project to mitigate those violations. GDS makes no representations regarding any siting or environmental aspects that may be part of the Application, nor has GDS been requested to provide an opinion regarding the optimization of the Project to determine if it is the optimum solution for the identified need.

REVIEW AND VERIFICATION OF POWER FLOW MODELS

GDS Staff reviewed the power flow models for consistency in generation dispatch, load, and topology between the Company's provided Base Case model and Project model. The Company provided four power flow models in response to Staff Interrogatory No. 3-27. These cases were for the 2019 and 2023 summer peak periods. Upon further review, GDS Staff determined that the power flow models were consistent with regards to generation dispatch, system topology, and load modeling. No issues were identified with the power flow cases used for the GDS analysis.

Company Witness Witt also referred to a "Stress Case" which had been evaluated by the Company.⁷¹ The purpose of this case was to identify the need date for the Project. The Stress Case assumes the loss of a critical system generator on top of the loss of another transmission system facility. Staff Interrogatory No. 3-29 requested information regarding all files necessary to review and verify the Company's results for the Stress Case, in order to confirm the Company's initial need date of 2018 projected to be caused by the overload of

⁷¹ Direct Testimony of David C. Witt at 8; Company's Response to Staff's Interrogatory No. 1-4.

the Gordonsville Substation 230-115 kV Transformer #3, and in order to examine any other potential conditions that may warrant further review.

REVIEW AND VERIFICATION OF INPUT FILES

In response to Staff Interrogatory No. 3-27, the Company provided a series of subsystem definition files (.SUB), contingency files (.CON), and monitored element files (.MON) which were necessary to perform the necessary analysis to review and verify the company results for the four power flow cases referenced above. GDS staff reviewed the input files to ensure that the power flow evaluation was performed on the proper part of the Company system, that the contingencies being considered were consistent with PJM requirements, and that the Company was monitoring all facilities that could be potentially impacted by the Project. In addition to the input files referenced above, Staff Interrogatory No. 3-29 requested information regarding all files necessary to review and verify the Company's results of the Stress Case.

GDS Staff successfully confirmed that the input files provided by the Company properly reflected the required analysis. No issues were identified with the Company's input files.

REVIEW AND VERIFICATION OF BASE CASE POWER FLOW RESULTS

GDS staff ran the four power flow models supplied by the Company in Staff Interrogatory No. 3-27, to be assured that the case would solve the identified violations, and that no thermal or voltage violations existed in the models prior to

any contingency analysis, consistent with NERC TPL Standards. GDS successfully verified that the Base Case results were acceptable.

GDS did not perform an evaluation of the power flow model supplied in response to Staff Interrogatory No. 3-29 due to the lack of a complete set of input files from the Company as requested, as well as the lack of Company results with which to compare the results of any independent review.

REVIEW AND VERIFICATION OF SINGLE CONTINGENCY (N-1)

RESULTS

The Company did not perform any N-1 analysis as the Project was designed to address N-1-1 violations as identified by PJM and the Company in the 2014 Stress Case.

REVIEW AND VERIFICATION OF MULTIPLE CONTINGENCY

(N-1-1) RESULTS

In response to Staff Interrogatory No. 3-27, the Company provided a series of output files based on a multiple contingency (N-1-1) analysis using the power flow models and associated input files. In order to review and verify the Company's results, GDS attempted to duplicate the same contingency analysis with the PowerGEM TARA software and determine if the Company results could be confirmed.

GDS Staff completed the N-1-1 analysis and was able to verify that the Company results used in the proceeding for the 2019 and 2023 evaluation were consistent with those calculated by the GDS independent analysis.

GDS Staff also completed the N-1-1 analysis on the Stress Case and was able to verify that the Company results were consistent with those calculated by the GDS independent analysis.

CONCLUSIONS

Upon reviewing the power flow models and input files, and completion of the independent verification of the results of the Company Application, GDS concludes the following regarding the Remington–Gordonsville 230 kV Transmission Line Project:

1. The power flow models used in the assessment of the Project for 2019 and 2023 have been successfully reviewed and verified by GDS and no issues were identified.

2. The input models used in the assessment of the Project for 2019 and 2023 have been successfully reviewed and verified by GDS and no issues were identified.

3. The Base Case Results for the 2019 and 2023 evaluation were successfully reviewed and verified by GDS and no issues were identified.

4. The multiple contingency (N-1-1) results supplied by the Company for the 2019 and 2023 evaluation have been successfully reviewed and verified by GDS and no issues were identified.

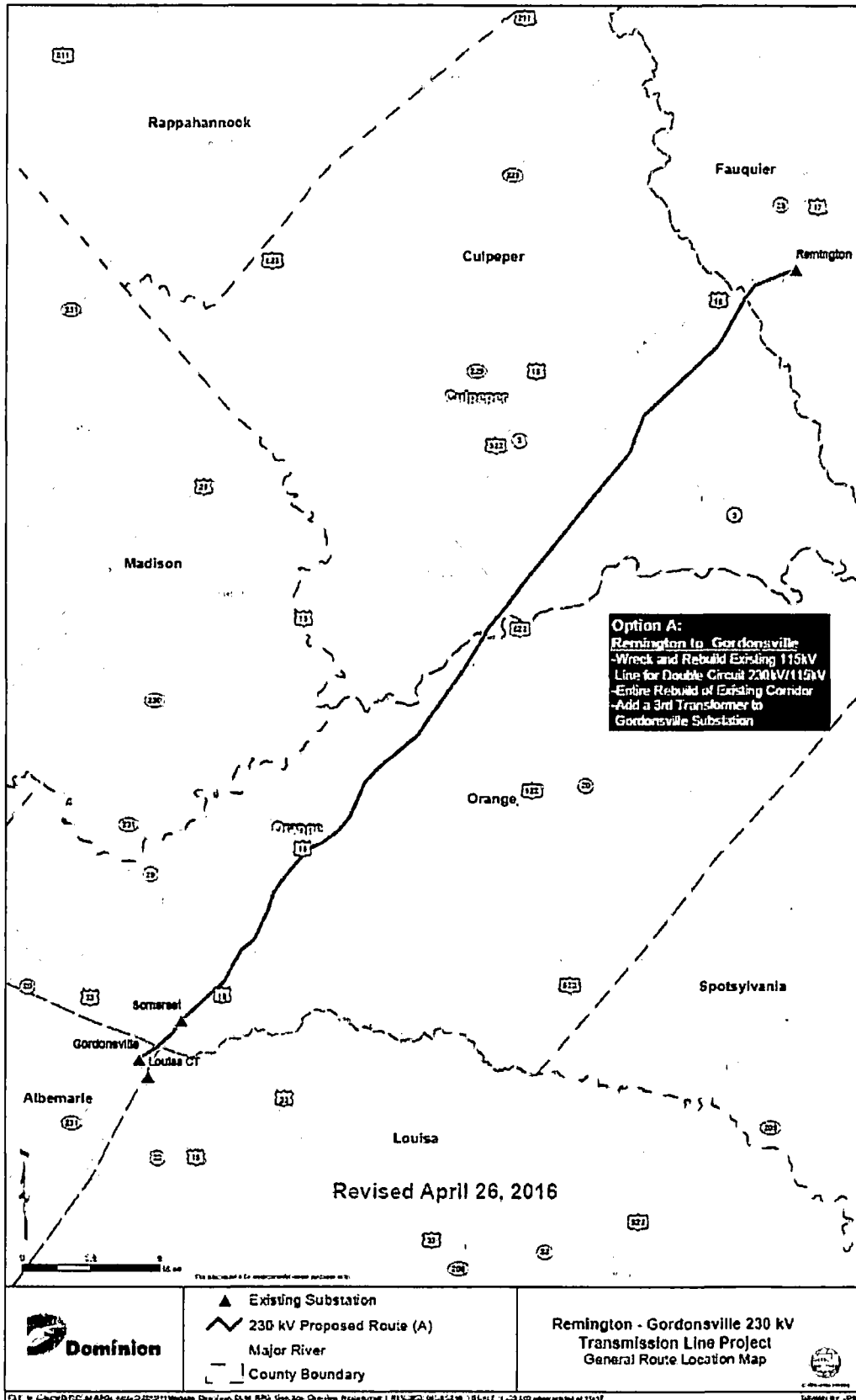
5. The multiple contingency (N-1-1) results supplied by the Company for the 2014 Stress Case have been successfully reviewed and verified by GDS and no issues were identified.

1 FINAL CONCLUSION

2 The Company referenced four separate power flow analyses in PUE-2015-
3 00117: 2014 Open Window #2, 2014 Stress Case, and the 2019/2023 Analyses
4 using the 2015 Load Forecast. GDS was only able to review and verify the
5 Company results for the 2019/2023 analysis with the 2015 Load Forecast and the
6 Stress Case. GDS agrees with the results of the power flow analysis performed by
7 the Company, and has successfully reviewed and verified the Company's analysis
8 for the Project. However, GDS has concerns regarding the completeness of the
9 Company's analysis and files related to the 2014 Open Window #2 and Stress
10 Case. The Company should provide all power flow models (base and change
11 case), input files and results for all scenarios referenced in Company filings, to
12 create a complete record for the review and verification process.

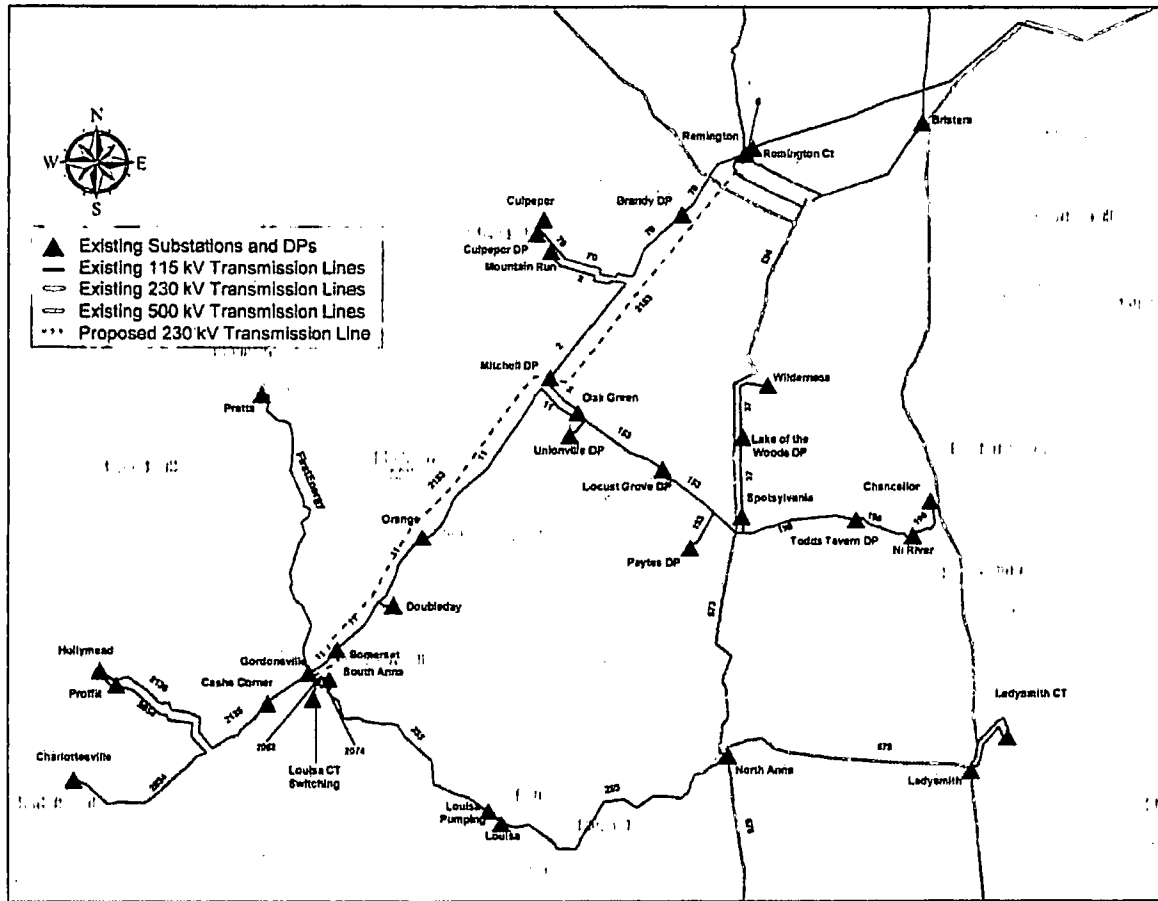
Attachment 1
Map of Proposed Route

160550154



Attachment 2

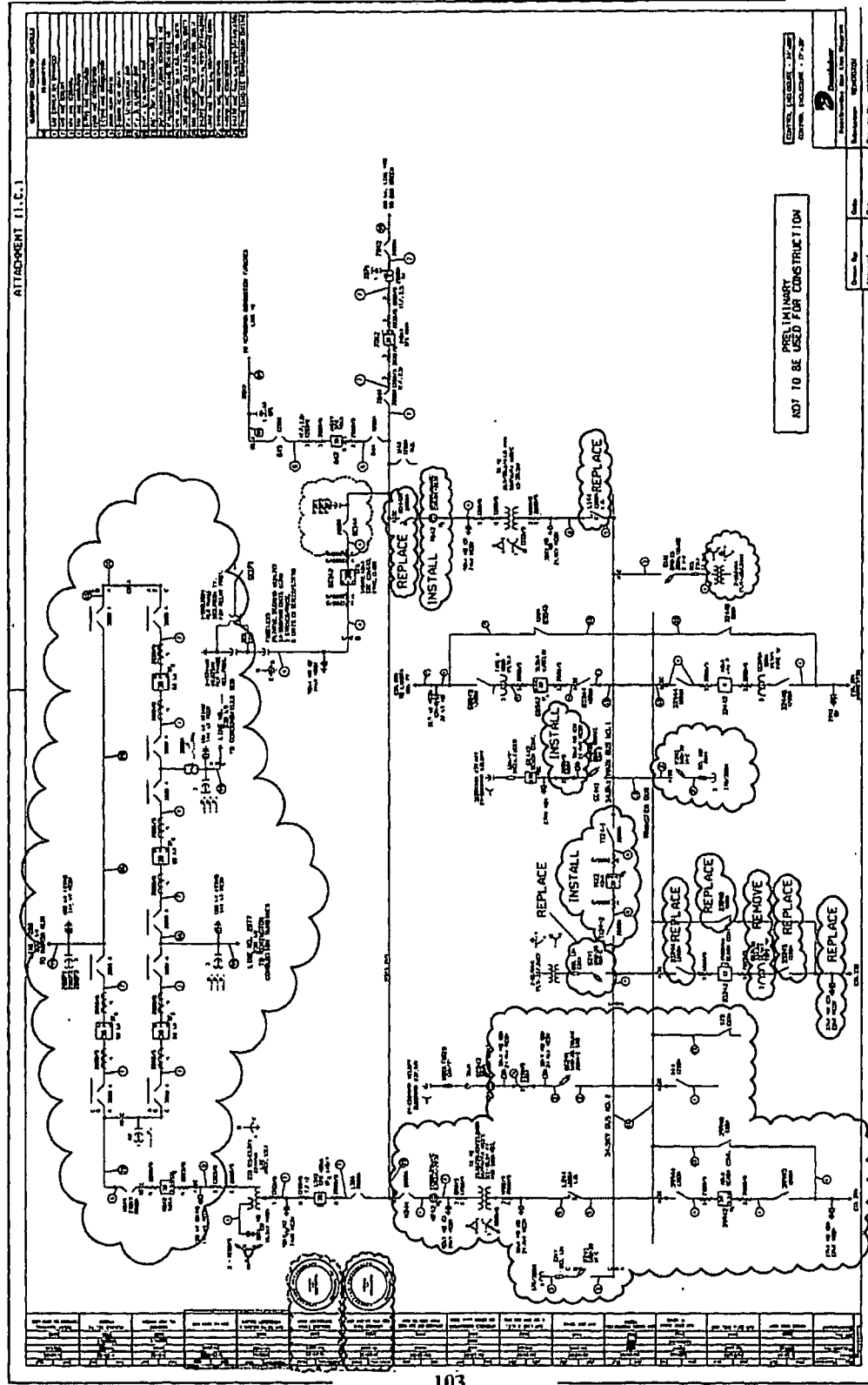
Transmission Line Network in the Project Area



Attachment 3

One-Line Diagrams of the Substations

One-line Diagram of Remington Substation



14
15
16
17
18
19
20
21
22





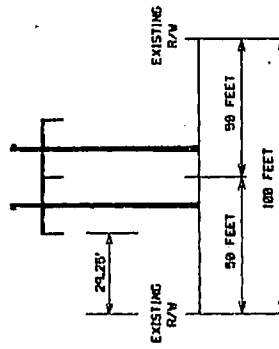
Attachment 4

ROW Cross-Sectional Views

Gordonsville – Somerset

GORDONSVILLE - SOMERSET

EXISTING
115KV CIRCUIT
(LINE #11)



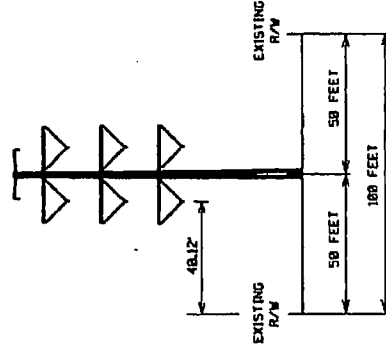
EXISTING CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

TYPE OF STRUCTURE: STEEL H-FRAME
FOUNDATION : DIRECT BURIED
APPROXIMATE AVERAGE HEIGHT: 69 FEET
WIDTH AT CROSSARM: 42 FEET
WIDTH AT BASE: 22 FEET
APPROX. AVERAGE SPAN LENGTH: 464 FEET
CONDUCTOR TYPE: ALUMINUM
RIGHT OF WAY WIDTH: 100 FEET
APPROXIMATE LENGTH OF LINE : 2.11 MILES

Existing

GORDONSVILLE - SOMERSET

EXISTING
115KV CIRCUIT
(LINE 11)
PROPOSED
230KV CIRCUIT
(LINE #2153)



PROPOSED CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

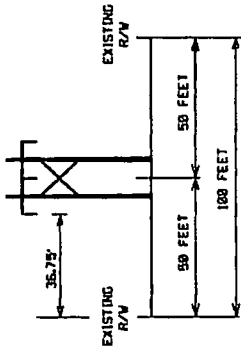
TYPE OF STRUCTURE: STEEL POLE
FOUNDATION : CONCRETE
APPROXIMATE AVERAGE HEIGHT: 103 FEET
WIDTH AT CROSSARM: 34 FEET
WIDTH AT BASE: 4 FEET
APPROX. AVERAGE SPAN LENGTH: 468 FEET
CONDUCTOR TYPE: ALUMINUM
RIGHT OF WAY WIDTH: 100 FEET
APPROXIMATE LENGTH OF LINE : 2.13 MILES

Proposed

Somerset – Oak Green Junction

SOMERSET - OAK GREEN JUNCTION

EXISTING
115KV CIRCUIT
(LINE #11)



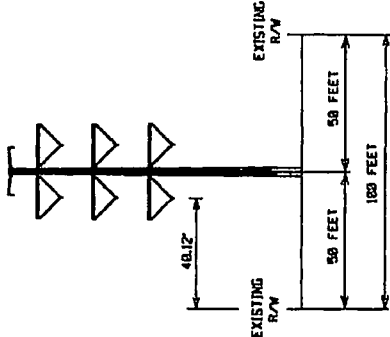
EXISTING CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

TYPE OF STRUCTURE: WOOD H-FRAME
FOUNDATION : DIRECT BURIED
APPROXIMATE AVERAGE HEIGHT: 52 FEET
WIDTH AT CROSSARM: 27 FEET
WIDTH AT BASE: 15 FEET
APPROX. AVERAGE SPAN LENGTH: 622 FEET
CONDUCTOR TYPE: ALUMINUM
RIGHT OF WAY WIDTH: 100 FEET
APPROXIMATE LENGTH OF LINE : 19.06 MILES

Existing

SOMERSET - OAK GREEN JUNCTION

PROPOSED
230KV CIRCUIT
(LINE #2153)
EXISTING
115KV CIRCUIT
(LINE 11)



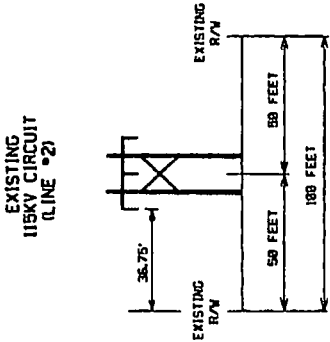
PROPOSED CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

TYPE OF STRUCTURE: STEEL POLE
FOUNDATION : CONCRETE
APPROXIMATE AVERAGE HEIGHT: 107 FEET
WIDTH AT CROSSARM: 34 FEET
WIDTH AT BASE: 4 FEET
APPROX. AVERAGE SPAN LENGTH: 625 FEET
CONDUCTOR TYPE: ALUMINUM
RIGHT OF WAY WIDTH: 100 FEET
APPROXIMATE LENGTH OF LINE : 19.86 MILES

Proposed

Oak Green Junction – Mountain Run Junction

OAK GREEN JUNCTION - MOUNTAIN RUN JUNCTION

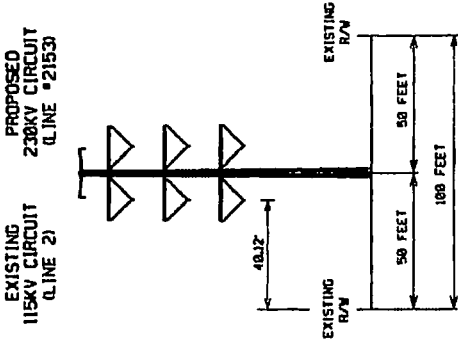


EXISTING CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

TYPE OF STRUCTURE:	WOOD H-FRAME
FOUNDATION :	DIRECT BURIED
APPROXIMATE AVERAGE HEIGHT:	50 FEET
WIDTH AT CROSSARM:	27 FEET
WIDTH AT BASE:	15 FEET
APPROX. AVERAGE SPAN LENGTH:	569 FEET
CONDUCTOR TYPE:	ALUMINUM
RIGHT OF WAY WIDTH:	100 FEET
APPROXIMATE LENGTH OF LINE :	6.89 MILES

Existing

OAK GREEN JUNCTION - MOUNTAIN RUN JUNCTION



PROPOSED CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

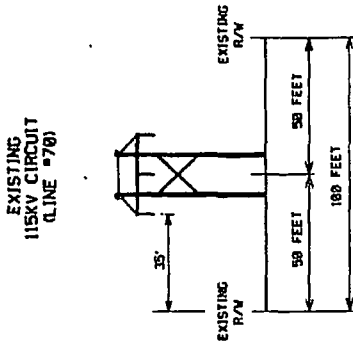
TYPE OF STRUCTURE:	STEEL POLE
FOUNDATION :	CONCRETE
APPROXIMATE AVERAGE HEIGHT:	106 FEET
WIDTH AT CROSSARM:	34 FEET
WIDTH AT BASE:	4 FEET
APPROX. AVERAGE SPAN LENGTH:	569 FEET
CONDUCTOR TYPE:	ALUMINUM
RIGHT OF WAY WIDTH:	100 FEET
APPROXIMATE LENGTH OF LINE :	6.89 MILES

Proposed

Mountain Run Junction – Remington Junction

MOUNTAIN RUN JUNCTION - REMINGTON JUNCTION

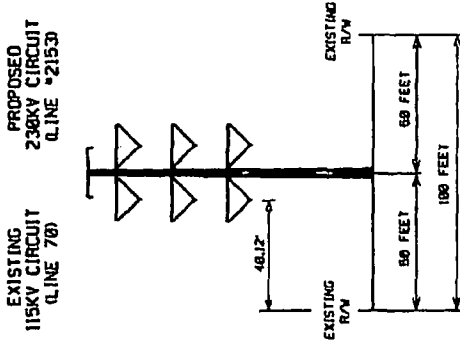
MOUNTAIN RUN JUNCTION - REMINGTON JUNCTION



EXISTING CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

TYPE OF STRUCTURE:	STEEL H-FRAME
FOUNDATION :	DIRECT BURIED
APPROXIMATE AVERAGE HEIGHT:	55 FEET
WIDTH AT CROSSARM:	30 FEET
WIDTH AT BASE:	16 FEET
APPROX. AVERAGE SPAN LENGTH:	526 FEET
CONDUCTOR TYPE:	ALUMINUM
RIGHT OF WAY WIDTH:	100 FEET
APPROXIMATE LENGTH OF LINE :	9.47 MILES

Existing



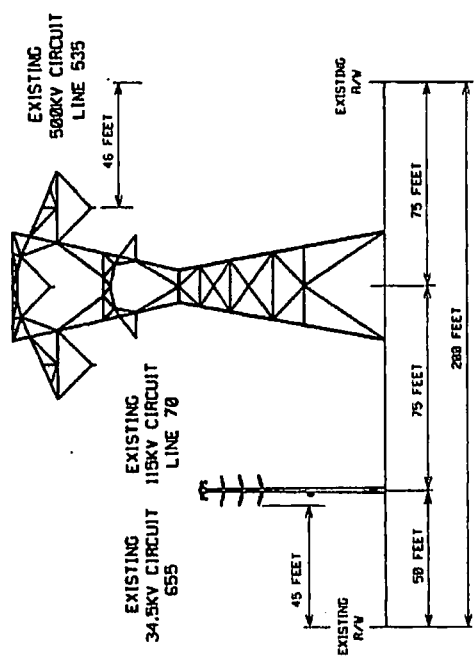
PROPOSED CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

TYPE OF STRUCTURE:	STEEL POLE
FOUNDATION :	CONCRETE
APPROXIMATE AVERAGE HEIGHT:	104 FEET
WIDTH AT CROSSARM:	34 FEET
WIDTH AT BASE:	4 FEET
APPROX. AVERAGE SPAN LENGTH:	532 FEET
CONDUCTOR TYPE:	ALUMINUM
RIGHT OF WAY WIDTH:	100 FEET
APPROXIMATE LENGTH OF LINE :	9.47 MILES

Proposed

Remington Junction - Remington Substation

REMINGTON JUNCTION - REMINGTON SUBSTATION

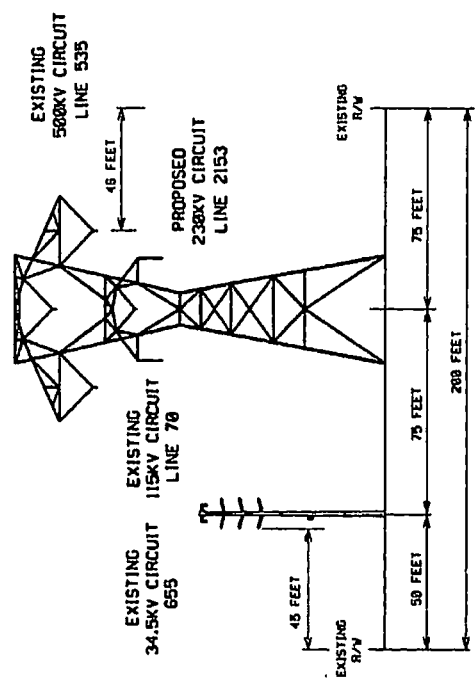


EXISTING CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

TYPE OF STRUCTURE: FOUNDATION:	WEATHERING STEEL POLE DIRECT BURIED	LINE 535 GALVANIZED STEEL TOWER CONCRETE
APPROXIMATE AVERAGE HEIGHT:	70 FEET	138 FEET
WIDTH AT CROSSARM:	10 FEET	84 FEET
WIDTH AT BASE:	2 FEET	40 FEET
APPROX. AVERAGE SPAN LENGTH:	246 FEET	1014 FEET
CONDUCTOR TYPE:	ALUMINUM	ALUMINUM
RIGHT OF WAY WIDTH:	200 FEET	200 FEET
APPROXIMATE LENGTH OF LINE :	0.62 MILES	0.62 MILES

Existing

REMINGTON JUNCTION - REMINGTON SUBSTATION



PROPOSED CONFIGURATION
TYPICAL RIGHT OF WAY LOOKING
TOWARD REMINGTON SUBSTATION

TYPE OF STRUCTURE: FOUNDATION:	WEATHERING STEEL POLE DIRECT BURIED	LINE 535 & 2153 GALVANIZED STEEL TOWER CONCRETE
APPROXIMATE AVERAGE HEIGHT:	70 FEET	138 FEET
WIDTH AT CROSSARM:	10 FEET	84 FEET
WIDTH AT BASE:	2 FEET	40 FEET
APPROX. AVERAGE SPAN LENGTH:	246 FEET	1014 FEET
CONDUCTOR TYPE:	ALUMINUM	ALUMINUM
RIGHT OF WAY WIDTH:	200 FEET	200 FEET
APPROXIMATE LENGTH OF LINE :	0.62 MILES	0.62 MILES

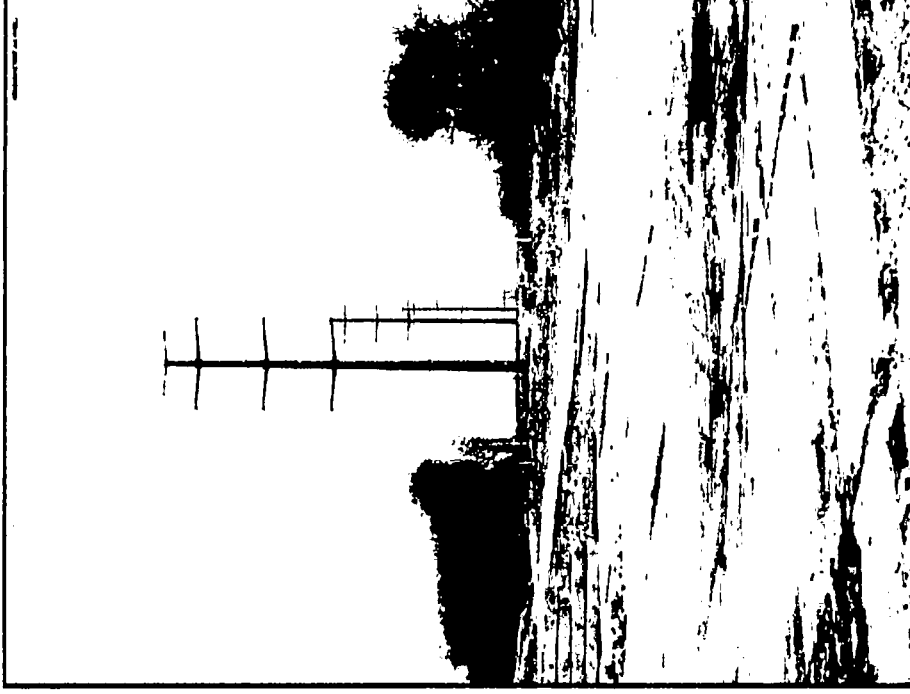
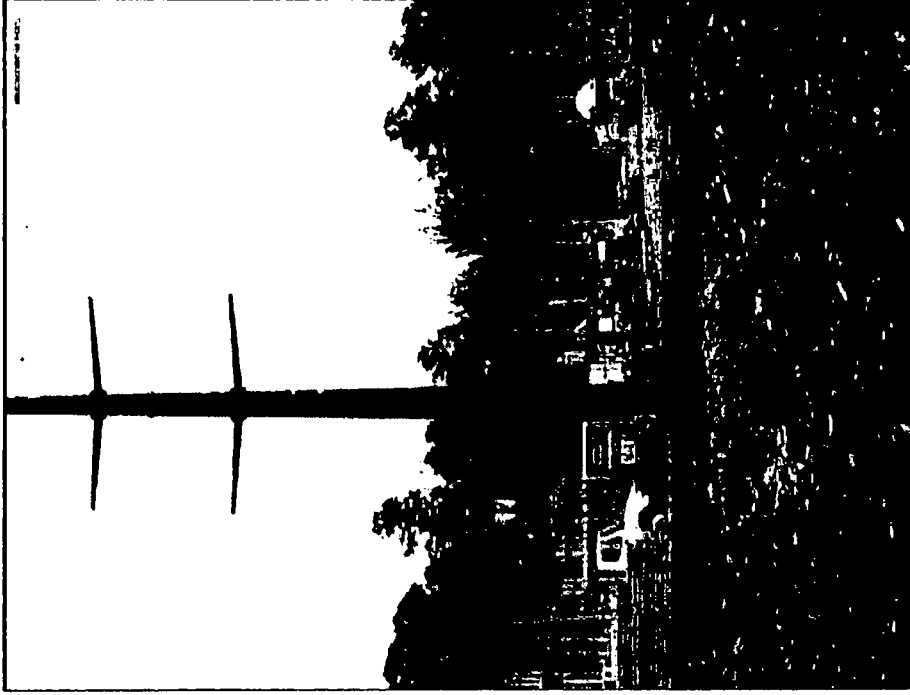
Proposed

451055097

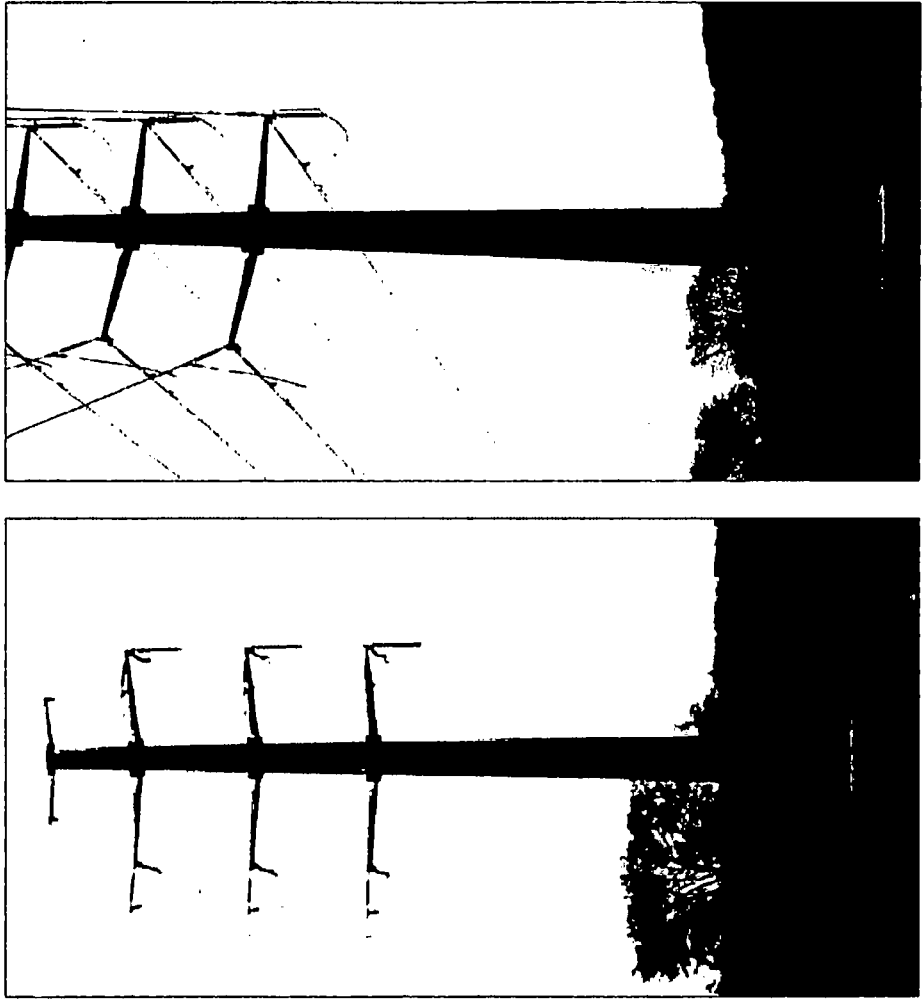
Attachment 5

Pictures of Projected Surface Finish for Proposed Structures

Example of Initial Surface Finish at Time of Installation



Example of Surface Finish after approximately 8 years of weather exposure



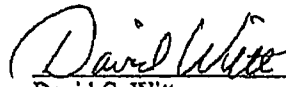
Attachment 6

Company's Responses to Staff's Interrogatory Requests

Interrogatory No. 1-4

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
First Set

The following response to Question No. 4 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on January 27, 2016 has been prepared under my supervision.



 David C. Witt
 Engineer III
 Dominion Virginia Power

Question No. 4

Please reference the Direct Testimony of David C. Witt at Page 4 which cites a Company-identified stress case violation of the Company's Transmission Planning Criteria for 2018, separate from the PJM-identified network violations. Please describe this Company-identified stress case violation.

Response:

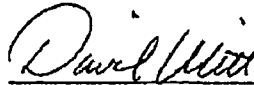
Dominion Virginia Power's Transmission Planning Criteria state that for a P3 Multiple Contingency, which entails "the outage of the most critical generator in the area being studied" coupled with the loss of a transmission circuit, 69-230 kV equipment should not be loaded beyond 94% of its emergency thermal limit.

Applying this analysis specifically to this case, the removal of the Company's 1,329-MW Warren County Power Station coupled with the loss of Line #2135 resulted in projected loading in 2018 of Gordonsville Substation 230/115 kV Transformer #3 in excess of 94% of its emergency thermal limit, which violates the Company's Transmission Planning Criteria.

Interrogatory No. 1-6c

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
First Set

The following response to Question No. 6(c) of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on January 27, 2016 has been prepared under my supervision as it pertains to transmission planning.


 David C. Witt
 Engineer III
 Dominion Virginia Power

Question No. 6

For the proposed 230 kV Gordonsville-Louisa Line # 2088 rebuild:

- (a) Please specify any changes that will be made to the existing transmission structures.
- (b) Please provide the rationale for replacing the existing ACSR conductor with ACSS/TW, and provide the cost differential between the two alternative conductor types if used for the rebuild.
- (c) Please state the summer load transfer capability of the existing line.

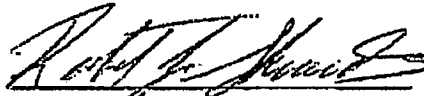
Response:

- (c) The summer emergency rating of existing Line #2088 is 818 MVA.

Interrogatory No. 1-8a

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
First Set

The following response to Question No. 8 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on January 27, 2016 has been prepared under my supervision.



Robert J. Shevenock II
 Consulting Engineer
 Dominion Technical Solutions, Inc.

Question No. 8

For the existing transmission lines in the Remington-Gordonsville 115 kV transmission line corridor:

- (a) Please state the total number of existing structures along the route.
- (b) Please provide the height of each existing structure along the route.

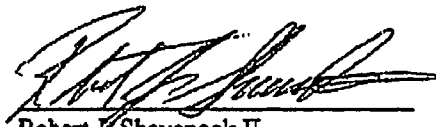
Response:

- (a) A total of 347 existing structures are along the route.
- (b) Listed below are the approximate heights of each structure along the route. The approximate heights do not include foundation reveal (a minimum of 18 inches) on existing structures with foundations for those structures identified below with an asterisk.

Interrogatory No. 1-9a

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
First Set

The following response to Question No. 9 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on January 27, 2016 has been prepared under my supervision.


 Robert J. Shevenock II
 Consulting Engineer
 Dominion Technical Solutions, Inc.

Question No. 9

For the Proposed Route of the 230/115 kV Remington—Gordonsville transmission line:

- (a) Please state the total number of structures planned along the route.
- (b) Please provide the planned height of each structure along the route.

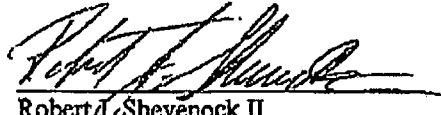
Response:

- (a) The total number of structures planned along the route are 346. This total is taken from the conceptual design created to estimate the cost for the Proposed Project.
- (b) Listed below are the approximate heights of each structure from the conceptual design created to estimate the cost for the proposed Project. The approximate heights do not include foundation reveal (minimum of 18 inches) and are also subject to change based on final design.

Interrogatory No. 1-11

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
First Set

The following response to Question No. 11 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on January 27, 2016 has been prepared under my supervision as it pertains to transmission line engineering.


Robert J. Shevenock II
Consulting Engineer
Dominion Technical Solutions, Inc.

Question No. 11

Please provide the rationale for selecting weathered steel for the structures in the Project, and provide the cost differential as compared to other possible alternatives.

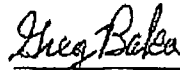
Response:

Galvanized steel poles would cost approximately 5.7% more than weathering steel poles, which would result in an increase of \$627,437 in the estimate for the proposed Project.

Interrogatory No. 1-11 (contd.)

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
First Set

The following response to Question No. 11 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on January 27, 2016 has been prepared under my supervision as it pertains to siting and permitting.



 Greg Baka
 Supervisor – Siting & Permitting
 Dominion Virginia Power

Question No. 11

Please provide the rationale for selecting weathered steel for the structures in the Project, and provide the cost differential as compared to other possible alternatives.

Response:

There are several reasons that the Company is proposing weathering steel structures for this Project. The existing structures along the Remington to Gordonsville corridor to be replaced are wooden structures and the weathering steel would more closely match the color of the existing structures as compared to galvanized structures. In addition, newer construction along the corridor has used weathering steel. The Oak Green Tap, fed by 115 kV Lines #2 and #11, was rebuilt in approximately 1999 using weathering steel structures, as was the Mountain Run Tap, fed by 115 kV Lines #2 and #70 and constructed in 2007. Also in 2007, the approximately 15-mile Line #70 was rebuilt using weathering steel structures. In 2015, approximately 2.0 miles of the southernmost portion of 115 kV Line #11 from Gordonsville Substation to Somerset Substation was rebuilt using weathering steel structures.

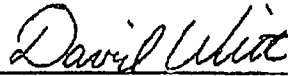
Finally, the Company received a great deal of public feedback from the open houses held in 2015 and described in Section III.B of the Appendix (pages 112-113) advocating the use of weathering steel structures to blend in better with the largely agricultural setting of the four counties that the corridor crosses and to be consistent with the existing tap lines.

These factors, along with the cost differential, support weathering steel as an appropriate structure material for this Project.

Interrogatory No. 2-15

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Second Set

The following response to Question No. 15 of the Second Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on February 24, 2016 has been prepared under my supervision.



David C. Witt
 Engineer III
 Dominion Virginia Power

Question No. 15

Please reference page 13 of the Appendix, a meeting slide from PJM's September 10, 2015 TEAC Meeting recommending the proposed Project for construction. The required in-service date is stated thereon as June 1, 2018. The Company's Application requests an in-service date of June 1, 2019. Please explain the rationale for this change and state whether this new date has PJM's concurrence.

Response:

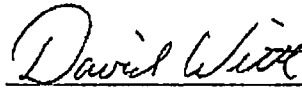
As described on page 4 of the Appendix, early planning analysis based on a 2014 PJM Load Forecast identified a 2018 need date to address a Dominion Virginia Power Criteria stress case violation that is now not projected to occur before 2019 under PJM's updated 2015 Forecast.

The June 1, 2019 in-service date has the concurrence of PJM and is shown on their Transmission Construction Status web site for project Upgrade ID b2686 at <http://www.pjm.com/planning/rtop-upgrades-status/construct-status.aspx>. A partial screen shot from that page is provided as Attachment Staff Set 2-15.

Interrogatory No. 2-16

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Second Set

The following response to Question No. 16 of the Second Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on February 24, 2016 has been prepared under my supervision.



David C. Witt
 Engineer III
 Dominion Virginia Power

Question No. 16

Please reference page 33 of the Appendix, Pn. 12, which states that "[t]he proposed Project also initially failed to resolve the identified violations in the PJM modeling but was subsequently reconsidered after appropriate adjustments were made by PJM to the modeling which showed that the Project did resolve all identified violations." Please describe the violations that were not resolved by the initial PJM modeling, and describe what adjustments were made to resolve those violations.

Response:

The violations that were not resolved by the initial PJM modeling involved the thermal overload of the Mitchell-Mt Run section of Line #2 in the event of the N-1-1 loss of 230-115 kV Transformer #3 at Remington Substation, in conjunction with the loss of either 115 kV Remington-Remington CT Line #6 or the 230-115 kV Transformer #9 at Remington CT Station. Initially PJM did not include the uprate of this section of Line #2 in their model. Dominion Virginia Power worked with PJM to include the uprate which addressed the identified overload.

Interrogatory No. 2-18

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Second Set

The following response to Question No. 18 of the Second Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on February 24, 2016 has been prepared under my supervision.



David C. Witt
Engineer III
Dominion Virginia Power

Question No. 18

Please provide the summer ratings of the existing 115 kV Lines #70, #2, and #11 that are to be up-rated in coordination with the proposed Project. Also state the benefits—system reliability or otherwise—of uprating only sections of these lines rather than uprating each complete line.

Response:

The summer ratings for sections of existing 115 kV Lines #70, #2, and #11 which are to be rebuilt in coordination with the Project are listed in the table below:

Line No.	Section	Summer Short Term Emergency (MVA)	Will section be rebuilt as part of the Project?
70	Remington to Remington Junction	353	No
70	Remington Junction to Brandy DP	386	Yes
70	Brandy DP to Mt Run Junction	386	Yes
70	Mt Run Junction to Mt Run	353	No
70	Mt Run to Culpeper	353	No
2	Mt Run to Mt Run Junction	353	No
2	Mt Run Junction to Mitchell	176	Yes
2	Mitchell to Oak Green Junction	231	Yes
2	Oak Green Junction to Oak Green	231	No
11	Oak Green to Oak Green Junction	231	No
11	Oak Green Junction to Orange	231	Yes
11	Orange to Doubleday DP	262	Yes
11	Doubleday DP to Somerset	262	Yes
11	Somerset to Gordonsville	353	Yes

Interrogatory No. 2-18 (contd.)

The Remington-Remington Junction, Mt Run Junction-Mt Run, and Mt Run-Culpeper sections of Line #70 and Mt Run-Mt Run Junction section of Line #2 that are not to be rebuilt as a part of the Project were recently rebuilt in the 2008-2009 timeframe. The Oak Green Junction to Oak Green Section of Line #2 and Oak Green to Oak Green Junction of Line #11 were recently rebuilt in the 2005-2006 time frame. Because these line sections were recently rebuilt, Dominion Virginia Power's planning model shows no need to uprate them.

Interrogatory No. 2-21

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Second Set

The following response to Question No. 21 of the Second Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on February 24, 2016 has been prepared under my supervision.


 Russell Meadows
 Electric T&D Projects Manager
 Dominion Technical Solutions, Inc.

Question No. 21

Please describe the Company's construction plans for the proposed Project, and how it will minimize service disruption in the affected load area. Please include a list of any PJM-approved outages during construction.

Response:

Dominion Virginia Power will sequence the outages on the 115 kV rebuild portion of the Project from north to south starting at Remington Substation. All the identified 115 kV transmission line sections to be rebuilt have loop feeds from the south. At each intersecting substation, the redundant feed will continue to supply power service delivery to each substation. There will be no service disruption to any of the customers served along the existing corridor for the Project. The addition of the 230 kV line will have no impact to the 115 kV supply along this route. There are presently no PJM-approved outages. Dominion Virginia Power has experience with each potential outage section along this corridor and based on its experience expects the requested outages to be granted. The remainder of the proposed work involves rework in the Company's existing Remington and Gordonsville Substations. The Company does not anticipate any service interruptions required with this work.

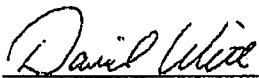
Interrogatory No. 2-22

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Second Set

The following response to Question No. 22 of the Second Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on February 24, 2016 has been prepared under my supervision as it pertains to regulatory accounting.

 David M. Wilkinson
 Manager – Regulation
 Dominion Resources Services Company, Inc.

The following response to Question No. 22 of the Second Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on February 24, 2016 has been prepared under my supervision as it pertains to PJM's allocation methodology.


 David C. Witt
 Engineer III
 Dominion Virginia Power

Question No. 22

Please provide the cost allocation methodology (including socialization) used for the Project.

Response:

The appropriately allocated costs of this Project, if approved, will be recovered from the Virginia jurisdictional customers through Rider T1, consistent with other 230 kV projects. The Project's costs will be allocated to the Virginia jurisdiction as part of the allocated Network Integration Transmission Service ("NITS") rate in the Rider T1 cost of service. Socialization of the Project's costs with other utilities will be determined by PJM Interconnection, L.L.C. ("PJM") and are subject to PJM's cost allocation rules. The costs allocated to each utility by PJM will be reflected in each utility's monthly PJM invoices. The Company's net share of these allocated

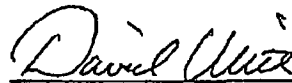
costs invoiced by PJM will likewise be included in the Rider T1 cost of service to be included in the recovery from Virginia jurisdictional customers.

The cost allocation methodology for this Project is detailed in section A.3.1 of PJM Manual 14B, available at <http://pjm.com/~media/documents/manuals/m14b.ashx>.

Interrogatory No. 3-27

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Third Set

The following response to Question No. 27 of the Second Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on March 28, 2016 has been prepared under my supervision.



David C. Witt
 Engineer III
 Dominion Virginia Power

Question No. 27

With regard to any analyses conducted by the Company to assess the effectiveness of the Project and any other alternatives in resolving the identified needs being solved by the Project:

- a) Please provide, in Siemens PSS/E v.33 compatible machine-readable, executable format, all power flow models, subsystem definition (.sub), monitored element (.mon), contingency definition (.con) and load throw-over (.thr) files used to conduct these analyses; and
- b) Please provide in machine-readable, executable format, all output files generated by the Company in these analyses.

Response:


See Attachments Staff Set 3-27 for the files containing the requested information.

These files include power flow models and analysis of both 2019 and 2023 cases based on PJM's January 2015 annual Load Forecast, PJM's N-1-1 Pratts Area case information that was provided with the 2014 Project Proposal Window #2 Problem Statement, and the case file information that was submitted jointly to PJM by the Company and FirstEnergy for Open Window #2.

Interrogatory No. 3-29

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Third Set

The following response to Question No. 29 of the Second Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on March 28, 2016 has been prepared under my supervision.



David C. Witt
Engineer III
Dominion Virginia Power

Question No. 29

Please provide, in Siemens PSS/E v.33 compatible machine-readable, executable format, all power flow models, subsystem definition (.sub), monitored element (.mon), contingency definition (.con) and load throw-over (.thr) files used to conduct any analysis performed by the company for the stress case analysis identified in Witt Direct at Page 4, lines 19 - 20.

Response:

See Attachments Staff Set 3-29 for the files containing the requested information. These files include the 2018 Transmission Owner ("TO") Criteria Stress Case that PJM presented in its 2014 Project Proposal Window #2 RFP. This information, along with the information provided in the attachments to the Company's response to Question No. 27 of the Staff's Third Set, was used to conduct analysis for the stress case identified in the Direct Testimony of Company witness Witt at 4:19-20.

160550154

Interrogatory No. 4-41

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Fourth Set

The following response to Question No. 41 of the Fourth Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on May 2, 2016 has been prepared under my supervision.



David C. Witt
Engineer III
Dominion Virginia Power

Question No. 41

Please provide the existing summer load transfer capability of 230 kV Line #2088 that is to be re-conducted. When is this line projected to exceed the new load transfer capability provided by the Project?

Response:

See the Company's response to Question No. 6(c) of the Staff's First Set for the existing rating of 230 kV Line #2088. Current network analysis projected out to 2023 does not show an overload condition for this line as configured by the Project. Therefore, with the proposed Project in service, no such exceedance is forecast within the planning period.

Interrogatory No. 4-43

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Fourth Set

The following response to Question No. 43 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on May 2, 2016 has been prepared under my supervision.

Greg Baba

 Greg Baba
 Supervisor – Siting & Permitting
 Dominion Virginia Power

Question No. 43

In reference to the structures planned for the Project:

- a. Please state whether the weathering steel structures proposed for the Project comply with the Virginia Outdoors Foundation's ("VOF") recommendation to use dulled steel structures for the Project (See Department of Environmental Quality ("DEQ") Report).
- b. Please provide color pictures showing the expected initial surface finish of a typical weathering steel structure to be used for the Project, and the projected surface finish of a "weather-dulled" structure after 5 to 10 years of weather exposure.
- c. Please provide similar pictures for a galvanized structure.

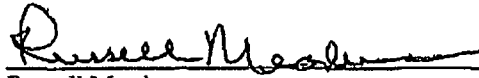
Response:

- a. The weathering steel structures that the Company has proposed for the Project consist of non-reflective, rust-colored or brown structures. These structures are consistent with the "dulled steel" structures requested by the VOF.
- b. Attachments Staff Set 4-43(1)-(2) (Dahlgren) are photographs of structures taken during the construction phase of the Company's Dahlgren transmission project (approved by Final Order issued October 4, 2012 in Case No. PUE-2011-00113) without conductors. Additionally, Attachments Staff Set 4-43(3)-(5) (Mountain Run) are photographs that were taken of structures constructed for the Company's Mountain Run Tap 115kV transmission project that are approximately 8 years old.
- c. Not applicable. The Company is proposing weathering steel for the proposed Project. See the Company's response to subpart (a) above.

Interrogatory No. 4-44

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Fourth Set

The following response to Question No. 44 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on May 2, 2016 has been prepared under my supervision.



Russell Meadows
Electric T&D Projects Manager
Dominion Technical Solutions

Question No. 44

Please state whether the Company plans to adopt the VOF's recommendation to use non-reflecting or de-glared conductors for the Project to reduce visual impact (See DEQ Report).

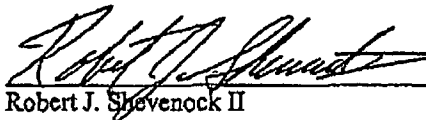
Response:

The Company's proposal is to use its standard conductors which are aluminum stranded wires that are silver in color until the wire begins to fade and dull to a muted gray as the aluminum metal oxidizes over time. Current estimates are that the incremental cost of non-reflecting or de-glared conductors for the Project would be approximately \$60,000.

Interrogatory No. 4-45

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Fourth Set

The following response to Question No. 45 of the Fourth Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on May 2, 2016 has been prepared under my supervision.



Robert J. Shevenock II
Consulting Engineer
Dominion Technical Solutions, Inc.

Question No. 45

Please provide the rationale for seeking an expansion of the right-of-way width from 70 feet to 100 feet in areas along the Proposed Route that are less than 100 feet in width.


Response:

Consistent with the Company's position in Case No. PUE-2014-00025 (approved by Final Order issued February 11, 2016), a 100-foot right-of-way is the width for double circuit 230 kV steel pole construction. See Attachment Staff Set 4-45 for the rebuttal testimony of Robert Shevenock in Case No. PUE-2014-00025 addressing this width requirement at pages 4-7.

Interrogatory No. 4-47

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Fourth Set

The following response to Question No. 47 of the Fourth Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on May 2, 2016 has been prepared under my supervision.


 Robert J. Shevenock II
 Consulting Engineer
 Dominion Technical Solutions, Inc.

Question No. 47

Please explain why the taller structures being proposed for the rebuild do not result in any significant increase in average span lengths or reduction in total number of structures proposed for the Project.

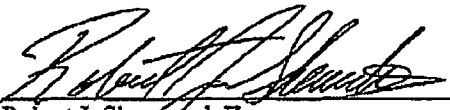
Response:

The Project was estimated as a structure for structure replacement in a 100-foot right-of-way while minimizing the proposed structure height. The height of the proposed double circuit steel pole is greater than the existing H-frame structures mainly due to the arrangement of the phase conductors vertically on the pole. This results in an approximate increase of 41-51 feet in the distance between the lowest conductor attachment and the top of the pole on the proposed tangent suspension structures in comparison to the existing 115 kV tangent suspension H-frame structures. The lowest conductor attachment elevation was increased on the proposed double circuit poles due to the increase in ground clearance for 230 kV operation (25.5-foot clearance for 230 kV in contrast to 23.5-foot clearance for 115 kV). The increase in the maximum operating temperature of the conductor will result in an increase in the conductor sag.

Interrogatory No. 4-48

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Fourth Set

The following response to Question No. 48 of the Fourth Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on May 2, 2016 has been prepared under my supervision.


 Robert J. Shevrick II
 Consulting Engineer
 Dominion Technical Solutions, Inc.

Question No. 48

For the structures DVP proposes to construct in the Remington Junction—Gordonsville Substation corridor, please provide the basis for selecting tower heights ranging from 103 to 107 feet as currently proposed.

Response:

The proposed approximate average pole heights will provide the Company-required 230 kV ground clearance in a structure-for-structure replacement in a 100' right-of-way. See the Company's response to Question No. 47 of the Staff's Fourth Set.

Interrogatory No. 4-50

Question No. 50

With a reference to the structures discussed in Question 49, state the incremental impact on cost and right-of-way requirements for the following:

- a. Shorter structures used along the entire wreck and rebuild corridor from Remington Junction to Gordonsville Substation; and
- b. Shorter structures used only along conservation easements and areas within the wreck and rebuild corridor where the Project's impact on historic resources is considered by the Company as "severe" (See Appendix F at Pages i-iii).

Response:

The Company objects to this request because it requires original work. Notwithstanding and subject to the foregoing objection, the Company provides the following response.

- a. As stated in the Company's response to Question No. 49 of the Staff's Fourth Set, the proposed structure heights were selected to provide the Company-required 230 kV ground clearance in a structure-for-structure replacement of the line in a 100-foot right-of-way. The use of shorter poles would require use of additional structures, resulting in additional cost and different impacts for the Project.

The existing right-of-way would need to be expanded to 180 feet to accommodate a hypothetical single circuit 230 kV H-frame alongside the existing 115 kV structures using the Company's standard design. The distance from the lowest conductor attachment to the top of the single circuit 230 kV H-frame is 20.1 feet, which is 40.5 feet less than the proposed double circuit steel pole. With the assumption of installing a single circuit 230 kV H-frame structure adjacent to the existing 115kV H-frame structure, the single circuit 230 kV H-frame tangent structure would allow an approximate 40.53-foot reduction in height compared with the proposed double circuit steel pole.

The existing right-of-way would need to be expanded to 140 feet to accommodate a hypothetical double circuit H-frame structure supporting the existing 115 kV line and new 230 kV line using the Company's standard design. The distance from the lowest conductor attachment to the top of the double circuit H-frame is 38.4 feet, which is 22.23 feet less than the proposed double circuit steel pole. Assuming a structure-for-structure replacement, the double circuit H-frame tangent structure would have an approximate 22.23' reduction in height compared with the proposed double circuit steel pole.

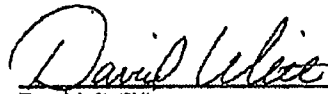
- b. See the Company's response to Question No. 53 of the Staff's Fourth Set regarding the Project's impacts on historic resources.

The Company is willing to work with property owners and agencies for additional right-of-way to allow for shorter structures for the Project. As stated in the Company's response to subpart (a) above, shorter structures require additional right-of-way width and/or additional structures. The Company notes that expansion of the existing right-of-way is more difficult in areas with existing easements designed to protect historic resources, and that the use of different types of structures within a relatively short length of line may lead to increased visual impacts.

Interrogatory No. 5-55

Virginia Electric and Power Company
Case No. PUE-2015-00117
Virginia State Corporation Commission Staff
Fifth Set

The following response to Question No. 55 of the Fifth Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on May 10, 2016 has been prepared under my supervision.



David C. Witt
 Engineer III
 Dominion Virginia Power

Question No. 55

Please reference Appendix at Page 4 and Company's Response to Staffs Interrogatory No. 2-15 which provides the rationale for shifting the in-service date of the Project from June 2018 to June 2019 based on load flow analysis performed using 2015 PJM Load Forecast Data. Please clarify whether the change of in-service date was driven solely by the results of this Company-identified stress case violation.

Response:

The 2018 Front Royal stress case, based on the Company's planning criteria, was the only driver identified by PJM for a June 2018 in-service date within PJM's 2014 Open Window #2 solicitation. Based on the updated 2015 PJM Load Forecast and analysis performed by both PJM and Dominion, the Front Royal stress case did not produce a violation for 2018.

With the elimination of the stress case condition for 2018, the in-service date shifted to 2019 to address the balance of violations listed within PJM's solicitation as described in Appendix Section I.B.